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INSTRUCTION MANUAL for

TENULINE®
model 8322
Coaxial Attenuator

Instruction Book

for

INSTALLATION-OPERATION-MAINTENANCE

Model 8322 TENULINE

Coaxial Attenuator

MODEL 8322 RF ATTENUATOR

Summary of Characteristics

ELECTRICAL SPECIFICATIONS

Power Rating	200 Watts
Nominal Attenuation	30 dB
Max. Frequency Deviation	±1/2 dB - DC to 500 MHz.
Calibration Frequencies	30, 100, 200, 300, 400, 500 MHz. @ ±0.2 dB.
RF Input & Output Impedance	50 Ohms Nominal
Input VSWR	1.10 Max.
Output VSWR	1.15 Max.
Input & Output Connectors	Female N
Ambient Air Temperature Range	-40°C to +45°C
Operating Position	Horizontal only

MECHANICAL SPECIFICATIONS

Weight	19 Lbs.
Finish	Light Navy Grey Baked Enamel (MIL-E-15090)
Dimensions	5-15/16" Wide, 8-1/2" Height 17-1/2" Long
Mounting Dimensions	5-1/8" x 14-5/8" Rectangle

MODEL 8322 TENULINE ATTENUATOR

SECTION I - GENERAL DESCRIPTION

The Model 8322 Attenuator is a low-reflection resistance network designed to facilitate measurement of high power in controllable known amounts. It is an electrical "T" pad immersed in a liquid coolant, using principles employed in Bird TERMALINE RF Load Resistors, which permit the use of large resistive Elements at high frequencies with a low VSWR over a wide frequency range. The Attenuator is designed to match most 50-ohm transmission lines.

The Model 8322 TENULINE is a self-contained instrument and designed to be fully cooled in normal ambient air. No additional equipment or outside power is required. The Attenuator unit is rectangular in shape with transverse cooling fins evenly spaced along its entire length. The front and rear fins are made extra thick and bent outward 90° to form mounting flanges. These flanges act as supports for free standing use or mounting brackets for optional fixed mounting. Mounting holes are provided for this purpose, see Installation, Section III.

The RF input and output connectors are of the Bird "Quick-Change" design to permit rapid interchange of connector types. These "QC" connectors are located on the front and back of the unit. See paragraph 4 of Maintenance, Section V for changing procedure.

A system of carbon film-on-ceramic cylindrical resistors immersed in a heat resistant dielectric coolant constitutes the RF Section Assembly.

The cooling fluid (G.E. 10 C Oil) and the tapered input resistor housing provide the proper electrical characteristics for the coaxial line attenuation throughout the internal circuitry. By convection, the oil carries the heat generated in the various resistor Elements to the walls of the coolant tank. This tank is encased in a set of radiating fins tightly pressed on the cylinder. These radiating fin surfaces dissipate the heat of the coolant tank into the surrounding air.

The unit may be used for isolation of power sources up to 200 watts and for low level monitoring. The low power value obtained at the output of the Attenuator could easily be read on an oscilloscope or terminated in a small RF load resistor such as the Bird Model 80F, etc.

SECTION II - THOERY OF OPERATION

The Model 8322 Attenuator is a symmetrical "T" pad, with the power distribution on the legs being different. Therefore, the size of resistor on each leg varies according to the percentage of power it is to absorb. A "T" configuration is used providing equal input and output impedances for the 50-ohm transmission line attenuation.

The input resistor is joined to the "T" leg joint in an exponentially tapered housing to provide a linear reduction in surge impedance directly proportional to the distance along the resistor. The output resistor is enclosed in a housing designed to return to the characteristic impedance of 50-ohms. This produces a uniform and practically reflectionless attenuation characteristic over the stated frequencies of the attenuator.

The dielectric coolant, (G.E. 10C Oil), is chosen for its desirable dielectric properties, to which the diameters of the resistors and housings are matched, and for its high thermal stability characteristics.

SECTION III - INSTALLATION

The RF Attenuator unit is self-contained. No additional equipment or outside power source is required. It should be placed as close as possible to the operating point as convenient. A retractable handle is affixed in the center of the top face of the radiator for ease in carrying the unit.

The Attenuator is designed for either fixed installation or portable use. By means of four 1/4-inch fasteners fed thru the 9/32 inch base flange holes, the unit may be secured to an operating table, bench, etc., on a 5-1/8" by 14-5/8" rectangular plane, or it may stand free if desired. This attenuator is designed for operation only in a horizontal plane, with mounting brackets down. NOTE: DO NOT OPERATE IN ANY OTHER MANNER.

SECTION IV - OPERATION

With suitable cable, such as RG-8A/U or RG-9B/U, and Male N Type connectors, connect the Model 8322 to the transmitting equipment and load. The front or input end of the Attenuator is identified by the four-inch diameter die-cast aluminum disc, on which the connector is mounted. The rear face of the unit is stencilled "OUTPUT" above the connector, and it has a cadmium plated dome-shaped tank closure. Care should be taken not to couple the Attenuator backwards to the direction of power flow. Destruction of the output resistor will result.

SECTION V - MAINTENANCE

1. GENERAL

The Model 8322 TENULINE Attenuator is rugged in construction and relatively uncomplicated in design. It should require only nominal routine attention. The Attenuator is intended to operate for long periods of time if care is taken not to exceed its power handling capabilities.

The outside surface of the instrument should be wiped free of dust and dirt when indicated. Clean the input and output connectors and their sockets if necessary, with Inhibisol, or its equivalent, or trichlorethylene, on a cotton swab stick. Take special care to clean the inner metallic surface and the exposed faces of the teflon insulators. Provide adequate ventilation and observe precaution when using dry cleaning solvents.

2. RF SECTION ASSEMBLY

Accurate measurement of the DC resistance between the input to ground, output to ground, and input to output will provide a good check of the condition of the Attenuator. For these measurements, a Resistive Bridge with an accuracy of one percent or better at 50 ohms (such as the Leeds & Northrop Model 5305 Test Set) should be used. Use low resistance leads, preferably a short piece of 50-ohm cable (RG-8A/U or RG-9B/U) attached to a Male N plug (UG-21/U) to match the Female N connectors on the Attenuator. When the resistance of the equipment is checked at room temperature, the measured readings should be close to the value listed on the data sheet shipped with the unit; namely, a nominal 93.7 ohms input to output and

50 ohms from either end to ground.

To replace the RF Section Assembly, carefully place the unit with the output end up. Release the V-band clamp by removing the #10-32 holding screw on its clamping blocks. Remove the domed end cover assembly, which has the specially designed center bushing sealing the Attenuator output housing. Be careful when disassembling not to damage the sealing ring on the dome ring diaphragm or the O-ring on the output housing. After the above parts are removed, pick up the unit and carefully pour the coolant into a clean container. Next, release the peripheral V-band clamp on the input end (front) of the Attenuator in the same manner as the rear end and remove. The RF Section Assembly is now free to be extracted from the input end of the radiator housing. This RF Section Assembly is not subject to further disassembly in the field. A defective assembly must be returned in its entirety for repair. To replace the RF Section Assembly, reverse the above procedure. Check the condition of the seals and take special care in the replacement of the central bushing of the output cover over the O-ring seal (#5-176) on the Attenuator body. If either of the O-ring seals show evidence of scars or deterioration, they should be replaced.

3. COOLANT

The level of the dielectric coolant should remain constant in the unit after prolonged usage under normal operating conditions. As shipped, the coolant level should be 7/8 of an inch from the top face of the output end of the cylinder when standing on its end. This allows for expansion of the coolant under power. Never fill the cylinder in its entirety. Inspect

occasionally around the lower portion of the clamping bands for possible coolant leakage. Tighten clamping screws if required. Under very unusual conditions, it might become necessary to replace the O-ring seal at the input end 8110-039, or output end (#5-176), or the special cover seal (#2430-089) on the output end. For replacement, proceed as described in paragraph 2, of this section.

4. RF INPUT AND OUTPUT CONNECTORS

The input and output connectors are both of a special Bird Quick-Change "QC" design which permits facile interchange of connectors with only simple tools. This process does not in any way distrub the coolant seal or interfere with the essential coaxial continuity of the Attenuator.

If replacement of the RF input or output connectors becomes necessary, proceed as follows:

(1) Remove the four #8-32 x 5/16" round head machine screws from the corners of the RF connector.

(2) Pull connector straight out.

(3) Reverse the above procedure to install new connector, making certain that the projecting center contact pin of the "QC" connector is carefully engaged and properly aligned with the mating socket of the Attenuator.

The "QC" connector may be readily replaced, as above, with other AN Standard Type connectors if specially obtained from Bird Electronic Corporation. Other "QC" connector types may be obtained from the manufacturer as follows;

Female N	4240-062	Female LC -	4240-031	Female C	4240-100
Male N	4240-063	Male LC -	4240-025	Male C	4240-110
Female HN	4240-268	Female LT -	4240-018	Female UHF (SO-239)	4240-050
Male HN	4240-278	Male LT -	4240-012	Male UHF (PL-259)	4240-179
		7/8" EIA - Airline			

REPLACEMENT PARTS LIST

Name	Part No.
RF Section Assembly	8322-002-1
Radiator Assembly	2440-020
Handle, Radiator	2440-009
Clamping Band Assembly	2430-055
End Cover Assembly	8322-005
Connector, Female N	4240-062
Coolant, G.E. 10C Oil - 0.7 gal.	5-030
O-Ring	8110-039
Seal	2430-089
O-Ring, Output Section Assembly	5-176

Bird Electronic Corp.
Cleveland, Ohio

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